

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	) Confirmation No.: 5721
Hidekazu MIYAIRI et al.	) Examiner: Jeffrey R. West
Serial No. 10/808,499	) Group Art Unit: 2857
Filed: March 25, 2004	)
For: METHOD FOR TESTING	)
SEMICONDUCTOR FILM,	)
SEMICONDUCTOR DEVICE AND	)
MANUFACTURING METHOD	)
THEREOF	)

**AFTER FINAL RESPONSE**

Honorable Commissioner of Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

The Official Action mailed January 28, 2010, has been received and its contents carefully noted. This response is filed within three months of the mailing date of the Official Action and therefore is believed to be timely without extension of time. Accordingly, the Applicant respectfully submits that this response is being timely filed.

The Applicant appreciates Examiner West's time in conducting a personal interview on March 18, 2010. As described in more detail below, during the interview the Applicant's representative explained that the claims of the present invention are directed to photographing of scattered light, which is distinct from the film quality inspecting method of Tsumura, which relies instead on a measuring beam. The Examiner agreed to consider the Applicant's remarks following the submission of this *Response*.

The Applicant notes with appreciation the consideration of the Information Disclosure Statements filed on April 16, 2007; and June 14, 2007.

A further Information Disclosure Statement was submitted on March 1, 2010, and consideration of this Information Disclosure Statement is respectfully requested.

Claims 1-3, 11, 18, 26, 28, 32, 34, 37, 39, 42, 44, 45, 47, 50, 52, 53, 55, 58, 60, 69, 71, 74, 76, 77, 79, and 82 are pending in the present application, of which claims 1, 3, 26, and 28 are independent. For the reasons set forth in detail below, all claims are believed to be in condition for allowance. Favorable reconsideration is requested.

Paragraphs 3 to 10 of the Official Action rejects claims 1-3, 11, 18, 26, 28, 32, 34, 37, 39, 42, 44, 45, 47, 50, 52, 53, 55, 58, 60, 69, 71, 74, 76, 77, 79, and 82 as obvious based on various combinations of U.S. Publication No. 2003/0016349 to Tsumura; U.S. Patent No. 6,647,148 to Ozawa, and U.S. Publication No. 2005/0041226 to Tanaka; U.S. Publication No. 2004/0228526 to Lin; U.S. Publication No. 2003/0142298 to Ujihara; and U.S. Patent No. 6,861,614 to Tanabe. The Applicant respectfully traverses the rejection because the Official Action has not made a *prima facie* case of obviousness.

As stated in MPEP §§ 2142-2144.04, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some reason, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some reason to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See

also In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The prior art, either alone or in combination, does not teach or suggest all the features of the independent claims. Independent claims 1, 3, 26 and 28 recite a method for testing comprising: irradiating a visible light on a surface of a semiconductor film, the semiconductor film having a crystallinity that has been improved by irradiating an energy beam; photographing a scattered light of the irradiated visible light to produce a digital image; and comparing a fluctuation obtained from relations between the approximate line and the average values of luminances (corrected saturations in claims 1 and 26) with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved. For the reasons provided below, Tsumura, Ozawa, Tanaka, Lin, Ujihara and Tanabe, either alone or in combination, do not teach or suggest the above-referenced features of the present invention.

The Official Action asserts that "Tsumura discloses a method for testing comprising irradiating a visible light on a surface of a semiconductor film (0027, lines 1-9), the semiconductor film having a crystallinity that has been improved by irradiating an energy beam (0063, lines 1-17); photo-transferring a scattered light of the irradiated visible light to form an image (0097, lines 1-12) and comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved (0076, lines 1-12)" (Paper No. 20100126, pages 2 to 3). The Applicant respectfully disagrees and traverses the assertions of the Official Action.

The Applicant respectfully submits that Tsumura describes a film quality inspection method comprising applying a measuring beam having a specific wavelength in a direction inclined with respect to the silicon film and measuring a reflection intensity or reflectivity of a beam reflected by the film (Abstract of Tsumura).

According to Tsumura, the criteria to decide the acceptability of a film is solely the level of reflectivity exhibited by the surface, fixed at 55% (Tsumura, paragraph [0054]). Further, Tsumura requires scanning of the surface (paragraph [0055]). The Applicant also submits that a beam projecting section 34 and a beam receiving section 36 have to be placed at specific angles, as denoted by the use of a goniometer 37 (Tsumura, Figure 3 and paragraph [0066]). In addition, any reference in Tsumura to "photo-electrically transferring" is respectfully submitted to be understood to be directed to the principle of operation of the sensor (i.e. photoelectric conversion) and not construed to imply "photography." Finally, Tsumura does not disclose or suggest "scattered light" as this term would be understood to a person of ordinary skill in the art familiar with photographic techniques, such as dark field photography as disclosed in the subject application.

On the other hand, the present invention is directed to taking a photograph, such as a dark field photograph, of scattered light and analyzing luminance in the digital image (see, at least, Abstract, and paragraphs [0024]-[0028] of the present application). The Applicant notes that a photograph of scattered light, or a dark field photograph, is readily understood by those of ordinary skill in the art to mean a photograph that excludes unscattered light and is wholly unrelated to measuring reflection intensity of a laser beam as described in Tsumura. Furthermore, the angles of light emission or detection are of no importance in the claimed invention. As shown for example in Figure 1, the CCD camera 1606, basically placed in a direction normal to the examined film, can optionally be placed obliquely, just for the sake of convenience or rapidity (see paragraph [0152]).

Accordingly, the Applicant respectfully submits that Tsumura, either alone or in combination with the other asserted prior art, does not teach or suggest photographing a scattered light of the irradiated visible light.

In addition, the Official Action concedes that Tsumura does not include specifics on how the image discriminator determines the corresponding locations but asserts that

Ozawa teaches a boundary line detecting method to determine areas with differences in light reflectance on a device surface..." and that "it would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura to include the specifics on how the image discriminator determines corresponding locations, as taught by Ozawa, because Ozawa suggests a corresponding method for determining borders caused by variations in brightness (column 5, lines 12-17), as applicable to the defect detection invention of Tsumura, that would have improved the accuracy of the defect detection by employing a method that is not limited by the arrangement of the photodetectors of the detection apparatus" (Paper No. 20100126, pages 4 and 5). The Applicant respectfully disagrees and asserts that it would not have been obvious to one of ordinary skill in the art at the time of the invention to combine Tsumura and Ozawa, for the reasons stated below.

The Official Action has not demonstrated that there was a reasonable expectation of success in combining Tsumura and Ozawa. Specifically, as mentioned above, the method of Tsumura measures the intensity of a reflected laser beam. On the other hand, Ozawa describes a boundary line detecting method. It is not apparent how the two incongruous methods would then be combined to achieve the present invention, let alone that there would be a reasonable expectation of success in combining them. Specifically, the Official Action does not explain what data, if any, the method of Ozawa would be applied to. That is, the Official Action has not explained how the boundary line detecting method of Ozawa, which is designed for simple predetermined shapes, may be applied to the reflected beams of Tsumura.

The Applicant further submits that the proposed combination of Tsumura and Ozawa would render Tsumura unsatisfactory for its intended purpose. Tsumura declares that "it is an object of the present invention to provide a film quality inspecting method and apparatus which can inspect a crystal state of a silicon substrate speedily and simply" (paragraph [0026] of Tsumura). As noted in MPEP § 2143.01, Part V, if a proposed modification renders the prior art invention being modified unsatisfactory for

its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Also, as noted in MPEP § 2143.01, Part VI, if a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The Official Action appears to propose a modification where Tsumura's method is modified to include the boundary line detecting method. However, if Tsumura were modified to include the additional computational requirements of Ozawa, then Tsumura would not achieve its result "speedily and simply" and would be rendered unsatisfactory for its intended purpose. That is, the Examiner's proposed modification or combination of the prior art appears to change the principle of operation of the prior art invention being modified. Therefore, there is no reason to make the proposed modification, and the teachings of the references are not sufficient to render the claims *prima facie* obvious.

Tanaka, Lin, Ujihara and Tanabe do not cure the deficiencies in Tsumura and Ozawa. Tanaka is relied upon to allegedly teach that a measurement is to be performed in a direction perpendicular to a scanning direction of light (page 6, *Id.*); Lin is relied upon to allegedly teach determining a corrected saturation value for an image (page 7, *Id.*); Ujihara is relied upon to allegedly teach an output of a halogen source (page 9, *Id.*); and Tanabe is relied upon to allegedly teach that a laser is applied as a pulse (page 10, *Id.*). However, Tsumura, Ozawa, Tanaka, Lin, Ujihara and Tanabe, either alone or in combination, do not teach or suggest photographing a scattered light of the irradiated visible light to produce a digital image or that Ozawa should be modified to include comparing a fluctuation obtained from relations between an approximate line and average values of corrected saturations with a reference value which is determined for a demanded performance of a semiconductor element in order to evaluate a crystallinity of a semiconductor film having crystallinity that has been improved. Since Tsumura, Ozawa, Tanaka, Lin, Ujihara and Tanabe do not teach or

suggest all the claim limitations and since there is insufficient reason to combine Tsumura and Ozawa, a *prima facie* case of obviousness cannot be maintained. Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 103(a) are in order and respectfully requested.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized to charge fees under 37 C.F.R. §§ 1.16, 1.17, 1.20(a), 1.20(b), 1.20(c), and 1.20(d) (except the Issue Fee) which may be required now or hereafter, or credit any overpayment to Deposit Account No. 50-2280.

Respectfully submitted,



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